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Attempt All Questions:

Q1: Describe the features of preprocessing and post processing.

Ans: Features of pre-processing:

- Pre-processing of digital images is largely automatic.
- Pre-image processing and post-image processing after image appearance, usually for the purpose of improving image contrast.
- A principal advantage of digital radiographic imaging over screen-film radiographic imaging is the ability to manipulate the image before display - pre-processing and after display post-processing.
- Pre-processing is designed to produce artifact-free digital images.
- The process of pixel interpola-

polation, lag correction and noise correction are automatically applied with most systems.

- It correct from dark reference zone.
- Averaging techniques also are used to reduce noise and improve contrast.
- Offset images and gain images are automatic calibration images designed to make the response of the image receptor uniform.
- Gain images are generated every few months, and offset images are generated many time each day.
- These preprocessing calibration techniques are identified as flat fielding.
- Digital image receptors and display devices have millions of pixels therefore, it is reasonable to expect some individual pixels to be defective and to respond differently as

or not at all.

- The response of pixels surrounding the defective pixel is averaged and the value is assigned to the defective pixel.
- Each type of digital image receptor generates an electronic latent image that may not be made visible completely.
- How dose techniques, such as switching from digital subtraction angiography to Fluoroscopy.
- This solution is application of an offset voltage before the next image is acquired.
- Some voltage variation may be seen along the buses that drive each pixel.
- This defect called line noise, can cause linear artifacts to appear on the final image.

Features of post-processing:

- Subtraction of digital radiograph images obtained months apart - temporal subtraction - is used to amplify change in anatomy or disease.
- The purpose of image subtraction is to enhance contrast.
- Mis-registration of a subtraction image occurs when the patient moves during serial image acquisition.
- This can be corrected by re-registering the image through a technique called pixel shift.
- The larger matrix size digital display devices have better spatial resolution because they have smaller pixel.
- This allows, among other properties, magnification of a

region of an image to rendered the smallest detail visible.

- Magnification in digital image is similar to using a magnifying glass with a film image.
- Greater use is being made of quantitative imaging. that is, use of numeric value of pixels to help in diagnosis.
- This requires identifying a region of interest (ROI) and computing the mean pixel value for that ROI.
- Edge enhancement is effective for fractures and small high contrast tissues.
- High lighting can be effective in identifying diffuse, non-focal disease, non-focal disease, Pan, scroll and Zoom allows for careful visualization of precise region of an image.

- Digital image post-processing label the image.
- It expand the digital grayscale to visible.
- It improve visualization and spatial resolution.
- It make white-black and black and white.
- It improve image ~~imag~~ contrast.
- Re-register an image to ~~contrast~~ correct for patient motion.
- Determine average pixel value for use in quantitative imaging.

Q2 Distinguish b/w spatial resolution & contrast resolution?

Ans: Spatial Resolution:-

- Spatial resolution refers to the ability of imaging instrument to provide the sharpness or detail of images.

- Factors affecting spatial resolution include collimator resolution (the main factor in nuclear medicine), system sensitivity requires certain diameter of the collimator holes etc.
- Spatial : pixel size: The size of the smallest possible feature that can be detected.
- In a digital image, the resolution is limited by the pixel size. i.e: the smallest resolvable object cannot be similar than the pixel size.
- Fine or high resolution image is one with a large resolution - size i.e: only coarse features can be observed in the image.
- Aerial photo has higher resolution.
- The image resolution and pixel size are not equivalent.

Contrast Resolution:

Contrast resolution is the ability to distinguish structures with similar subject contrast such as liver-spleen, fat muscle.

- Computed tomography and MRI have excellent contrast resolution. Convention radiology is Fair to Poor.
- Spatial & contrast resolution interact.
- High contrast objects are easier to resolve.
- Improve one at the expense of the other.
- It can only improve both by increasing dose.
- Contrast resolution increases as speckly noise decreases, generally resulting in loss in spatial resolution.
- Both contrast and spatial resolution can be improved by reducing sample volume.

Qs: Discuss the characteristics of digital imaging that should result in lowest patient radiation doses.

Ans: Characteristics:

- Digital imaging techniques must be approached differently. Instead of dose creep, technique creep should be used with each of the various digital imaging systems.
- The result will be patient radiation dose reduction.
- Because digital image contrast is unrelated to dose, kvp becomes less important.
- When digital examination of specific anatomy is conducted, the kvp should start to be increased, and an accompanying reduction in mAs should be noted with successive examinations.
- The result will be adequate

contrast resolution, constant spatial resolution and reduced patient radiation dose.

- The patient radiation dose reduction that is possible is limited.
- The problem with very low technique for digital imaging is low SNR. Noise can predominate and compromise the interpretation of soft tissue anatomy.

Dose reduction with Digit radiography:

- Exposure should not be repeated in digital radiography because of brightness or contrast concerns.
- DR systems cannot compensate for excessive noise caused by quantum mottle.
- Over exposed images do not have to be repeated and should not become a habit.

Q4 Discuss the features of an active matrix display.

Ans: Features of active matrix displays:

- An active-matrix liquid crystal display (AMLCD) is a type of flat-panel display, the only viable technology for high resolution TVs, computer monitors, note book computers, tablet computers and smart phones with an LCD screen, due to low weigh, very good image quality, wide color gamut and response time.
- We all know that matter takes the form of gas, liquid or solid.
- A liquid crystal is a material state between that of a liquid and a solid.

- A liquid crystal has the property of a highly ordered molecular structure - a crystal and the property of a viscosity a fluid.
- AMLCDs are superior to CRT displays.
- Medical flat panel digital display devices are identified by the number of pixels in the AMLCD.
- A 1-mega pixel display will have a 5-mega pixel display or a 2500-X 2500 pixel arrangement.
- Table 18.3 reports the matrix array for popular medical flat panel digital display devices.

Q5 Identify application of picture archiving and communication system (PACS)?

Ans: A picture archiving and communication system (PACS) is a medical imaging technology which provides economical storage and convenient access to images from multiple modalities (source machine types). Electronic images and reports are transmitted digitally via PACS; this eliminates the need to manully file, retrieve or transport film jackets, the folders used to store and protect x-ray film. The universal format for PACS image storage and transfer is DICOM (Digital imaging and communication in Medicine).

The four principal components

of a PACS are the image acquisition system, the display system, the network and the storage system. Instead medical documentation and images can be securely housed in off-site servers and safely accessed essentially from any where in the world using PACS software, work stations i.e mobile devices. Medical imaging storage technologies such as PACS are increasingly important as the volume of digital medical images grows throughout the health care industry and data analytics of those images becomes more prevalent.

Q16 Discuss the three types of digital radiographic imaging artifacts and how to avoid them.

Ans: There are three types of digital radiographic imaging artifacts.

(1) Image receptor artifacts.
(2) I/P processing artifacts
(3) Image - receptor artifacts.

(1) Image receptor artifacts:

- Digital image receptors can suffer from rough handling, scratches and dust.
- Artifacts produced by dust can be corrected easily with proper cleaning unless the dust is internal to the optics of a computed radiography imaging systems.
- Dust on any section of the CR optical path: mirrors,

and lenses cannot be corrected by the radiologic technologist and will require professional service.

- Scratches or a substantial malfunction of pixels likely will require replacement of the image receptor.
- Digital radiographic image receptors have unique artifacts associated with pixel failure.
- Environmental radiation can contribute ghost artifacts.
- Usually such artifacts can be corrected by additional signal erasure techniques.

(P.T.O) Pre-processing artifacts:

Before an image is prepared for processing several manipulations of the output of an image receptor may be necessary

to correct for potential artifacts. Such artifacts can occur because of dead pixels.

- A single pixel or a single row of column normally will not interfere with diagnosis.
- However, many of these defects must be corrected
- Irradiation of a digital radiographic image receptor by the raw x-ray beam may show variations over the image, producing an irregular pattern that could interfere with diagnosis.
- With this irregular pattern, a pre-processing manipulation known as Flat Fielding is performed, resulting in a uniform response to a uniform.
- Flat fielding is a software correction that is performed to equalize the response of each pixel to a uniform x-ray

x-ray beam.

(3) Software artifacts:

- Digital radiographic images are obtained as raw data sets.
- As such, these images are ready for processing.
- For processing images are manipulated into 'for presentation' images that the radiologic technologist can use for QC and for interpretation by the radiologist.

Object artifact:

- Image Histogram
- Collimation and Partition
- Alignment

How to avoid?

- Artifacts interfere with diagnosis we must be avoided.
- Similar to accidents artifacts are avoidable.
- Artifacts can be controlled when the cause

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Q7: Describe the basis for data compression and the difference b/w loseless and lossy compression.

Ans Data compression is a technique in which the size of data is reduced without loss of information. Lossy compression and loseless compression are the categories of data compression method. The main difference between the two compression techniques (lossy compression and loseless compression) is that, the lossy compression technique does not restored the data in its original form, after decompression on the other hand loseless compression restores and rebuit the data in its original form, after decompression.

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Difference b/w loosy compression and loseless compression:

Loosy Compression:	Loosless compression:
(1) Loosy compression is the method which eliminate the data which is not noticeable	• While lossless compression does not eliminate the data which is not noticeable.
(2) In Lossy compression, A file does not restore or rebuilt	• While in Lossless compression, A file can be restored in its original form.
(3) In Loosy compression, Data's quality is comprised.	• But Lossless Compression does not compromise the data's quality.
(4) Loosy compression reduces the size	• But loosless compression

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	of data.	does not reduce the size of data.
(5)	Loosy compression is used in images, audio, video.	• Loosless compression is used in Text, images, sound.
(6)	Lossy compression has more holding data capacity.	• Loosless compression has less data-holding capacity than lossy compression technique.
(7)	Loosy compression is also termed as irreversible compression.	• Lossless compression has less data is also termed as reversible compression.

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Q8 Identify the difference b/w Processing image and ~~processing~~ presentation images.

Ans: For processing & For presentation:

- These images are manipulated into for presentation images that can then be used by the rad tech for Q.C.
- Digital radiographic images are obtained as raw data sets. As such, these images are ready for processing.
- For processing images are manipulated into for presentation images that the radiologic technologist can use for interpretation by the radiologist.
- The process of assigning a value to a dead pixel based on the recorded values of adjacent pixels.

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Q4 Explain how digital radiographic image artifacts occur because of improper collimation, partition or alignment?

Ans: Object artifact can arise from the technologist's errors in patient positioning, x-ray beam collimation and histogram selection.

- Black scatter radiation also can be trouble some because of the sensitivity of the digital radiographic image receptor.

Collimation & partition:

- If the x-ray exposure field is not properly collimated, size and positioned, exposure field recognition may occur.
- The result is very dark or very noisy images.

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- Automatic radiation field recognition ~~error may occur~~ is essential for artifact free images.
- Collimation of the projected area x-ray beam is important for patient radiation dose reduction and for improved image contrast in screen film radiography.
- Proper collimation and centering prevent histogram errors that can lead to artifacts.
- If multiple field are projected onto a single IP, each must have clear, collimated edges and margins between each field. This process, called partitioning allows two or more images to be projected on a single I.P.
- Partitioning of multiple digital images on a single IP results in proper separation and collimation of each image.

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Alignment:-

- Alignment of the exposure field on the I.P is important in the same way and for the same reason as collimation.
- When an image field, such as that is not oriented with the size and dimensions of the I.P, image artifacts can appear.

[THE End]